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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/519,408	03/03/2000	Takao Nakamura	3905	7245

21553 7590 02/03/2003

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EXAMINER

LOUIE, WAI SING

ART UNIT PAPER NUMBER

2814

DATE MAILED: 02/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/519,408

Applicant(s)

NAKAMURA ET AL.

Examiner

Wai-Sing Louie

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 19 November 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 16 and 19-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 16 and 19-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 21 & 24
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## DETAILED ACTION

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 24 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

- In claim 24, "so as to cover first areas of said p-type semiconductor layer while leaving second areas of said p-type semiconductor layer uncovered" is not disclosed in specification, which is a new matter.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 24 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- In claim 24, "said Au thin film is discontinuous so as to cover said p-type semiconductor", and "said n-type transparent semiconductor film covers Au thin film" is indefinite. How can an n-type electrode cover a p-type Au thin electrode?

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For the purpose of examination, "an transparent semiconductor film covers the Au thin film" is assumed.

- In claim 28, is the upper electrode includes an Au thin film and an n-type transparent semiconductor film? The upper electrode 10, in according to fig. 2, is a p-type electrode.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 16, 19-20, and 22-23 (in so far as they are understood) are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi et al. (US 5,617,446) in view of Kazuyoshi et al. (JP 06-318406) and Woodard et al. (US 6,255,003).

With regard to claim 16, Ishibashi et al. disclose a semiconductor light-emitting device (col. 3, line 8 to col. 9, line 58 and fig. 2) comprising:

- A substrate 1 provided with an n-type lower electrode on the back surface;
- A light-emitting layer 6 provided on the substrate 1;
- A p-type semiconductor layer 12 provided on the light-emitting layer 6;
- An upper electrode 13 and 14 provided on the p-type semiconductor layer 12, where the upper electrode includes an Au thin film positioned in contact with the

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p-type semiconductor layer 12, but do not disclose the thickness of the Au thin film is 1 nm to 3 nm. However, Woodard et al. teach that Au has an effective thickness as thin as one-tenth of a full 3 Å thick monolayer and not a continuous layer (Woodard col. 5, lines 20-24). Woodard et al. disclose the common thickness of a transparent Au thin film is about 1 to 10 Å (Woodard col. 5, lines 24-28) and film 104 in Woodard's device is 0.6 to 30 Å (Woodard col. 5, line 26 and fig. 1). Therefore, it would have been obvious at the time the invention was made to modify Ishibashi's device with the teaching of Woodard et al. to provide an Au thin film of less than 3 nm thick in order to provide a thin, conductive, and transparent film;

- Ishibashi et al. do not disclose the n-type transparent electrode is made of an  $\text{In}_2\text{O}_3$ -10wt.% ZnO thin film. However, Kazuyoshi et al. disclose a transparent semiconductor layer, which is made of In and Zn compound (Kazuyoshi [0008]). Kazuyoshi et al. teach that this compound is transparent, conductive, resistant to heat and high humidity, and is suitable to be a transparent electrode (Kazuyoshi [0018]). Hence, it would have been obvious at the time the invention was made to modify Ishibashi's device with the teaching of Kazuyoshi et al. to provide an n-type transparent semiconductor  $\text{In}_2\text{O}_3$ -ZnO layer in order to seal the air and humidity from the light-emitting device. Kazuyoshi et al. disclose an  $\text{In}_2\text{O}_3$ -20wt.% ZnO thin film (Kazuyoshi [0014]). However, in the case where the claimed ranges "overlap or lie inside the ranges disclosed by the prior art" a prima facie case of obviousness exists (*In re Wetheim*, 541 F.2d 257, 191 USPQ 90).

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(CCPA 1976); *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990)). Similarly, a prima facie case of obviousness exists where the claimed ranges and the prior art ranges do not overlap but are close enough that one skill in the art would have expected them to have the same properties (*Titanium Metals Corporation of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985); See MPEP 2144.05)

With regard to claim 19, Ishibashi et al., modified by Kazuyoshi et al. in claim 16 above, would have an  $\text{In}_2\text{O}_3$ .10wt.% ZnO layer, but they do not disclose the  $\text{In}_2\text{O}_3$ .10wt.% ZnO layer is formed by laser ablation. However, this is a process limitation, which carries no patentable weight in a claim drawn to a device.

With regard to claim 20, Ishibashi et al., modified by Woodard et al. in claim 17 above, disclose an Au thin film has a thickness of 0.6 to 30 Å and Ishibashi et al., modified by Kazuyoshi et al. in claim 16 above, disclose an  $\text{In}_2\text{O}_3$ .10 wt.% ZnO layer. Kazuyoshi et al. disclose the thickness is 10 to 800 nm (Kazuyoshi [0017]).

With regard to claim 22, Ishibashi et al. modified by Kazuyoshi et al. would have an n-type transparent semiconductor film of  $\text{In}_2\text{O}_3$ .10 wt.% ZnO layer. Kazuyoshi et al. disclose the transparent conductor film is form @room temperature (Kazuyoshi [0066]). "The device has characteristics result from the n-type transparent semiconductor film having been deposited @room temperature" is written in process limitation, which carries no patentable weight in a claim drawn to a device.

With regard to claim 23, Ishibashi et al. disclose the p-type semiconductor layer 12 is a ZnTe based semiconductor layer (col. 3, line 32).

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi et al. (US 5,617,446) modified by Kazuyoshi et al. (JP 06-318406) and Woodard et al. (US 6,255,003) as applied to claim 16 above, and further in view of Lawrence et al. (US 4,495,514).

With regard to claim 21, Ishibashi et al. disclose a multi-layer structure upper electrode, but do not disclose the lower layer having a flattened surface and the upper layer having an uneven surface. However, Lawrence et al. disclose an electrode having a thin gold layer, which is a flattened layer, and an uneven upper transparent layer (Lawrence col. 6, lines 44-57). Lawrence et al. teach the thin gold layer could reduce the contact resistance at the electrode-semiconductor interface (Lawrence col. 6, lines 47-50). Therefore, it would have been obvious to one with ordinary skill in the art to modify Ishibashi's device by the teaching of Lawrence et al. to provide a thin gold flattened layer and an uneven transparent electrode in order to reduce the contact resistance at the electrode-semiconductor interface.

Claims 24-28 (in so far as they are understood) are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi et al. (US 5,617,446) modified by Kazuyoshi et al. (JP 06-318406) and Woodard et al. (US 6,255,003) as applied to claim 16 above, and further in view of Okazaki (US 5,990,500).

With regard to claims 24-25, Ishibashi et al., modified by Woodard et al. in claim 16 above, would disclose a discontinuous thin Au film, but do not disclose an IZO type transparent film covers the thin Au film. However, Okazaki discloses an ITO transparent semiconductor film cover a layer of thin metal layer made of Au and its alloy (Okazaki col. 3, lines 4-12). Okazaki

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teaches the thin metal ensures good ohmic contact with the p-type semiconductor layer and the ITO transparent semiconductor film provides uniform current injection and reduces sheet resistance of the thin metal electrode (Okazaki col. 3, lines 12-16). Therefore, it would have been obvious at the time the invention was made to modify Ishibashi's device with the teaching of Okazaki to provide a ITO type transparent semiconductor film over the thin Au film in order to ensure uniform current injection.

With regard to claims 26-27, the claim is written in process limitation, which carries no patentable weight in a claim drawn to a device.

With regard to claim 28, Ishibashi et al., modified by Okazaki in claim 24 above, would disclose the p-type electrode includes an Au thin film and a transparent semiconductor film. Okazaki discloses the solid continuous metal film and the transparent semiconductor film do not include a grid-shaped electrode (Okazaki fig. 1a).

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ishibashi et al. (US 5,617,446) modified by Kazuyoshi et al. (JP 06-318406) and Woodard et al. (US 6,255,003) as applied to claim 16 above, and further in view of Yamashita et al. (US 6,271,460).

With regard to claim 29, Ishibashi et al. disclose an Au thin film in contact with the p-type semiconductor layer, but do not disclose an n-type transparent semiconductor layer on the Au thin film forming a pn-junction. However, Yamashita et al. disclose an Au thin film interposed at a pn-junction of an n-type and a p-type semiconductor (Yamashita fig. 2). Yamashita et al. teach joining the p-type and n-type semiconductor layers with a thin metal layer would form a Schottky barrier between metal and semiconductor and an electromotive force will



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be generated (Yamashita col. 7, lines 3-9). Therefore, it would have been obvious to one with ordinary skill in the art to modify Ishibashi's device with the teaching of Yamashita et al. to provide an interface between the p-type and n-type semiconductor layers in order to form an Schottky barrier. Ishibashi et al., Modified by Woodard et al. in claim 16 above, would disclose the thickness is 0.6 to 30 Å.

### *Response to Arguments*

Applicant's arguments filed 11/19/02 have been fully considered but they are not persuasive.

- Applicant argues that Ishibashi et al. do not disclose an n-type semiconductor material in or adjacent to the upper electrode structure and there is no risk or issue of formation of a p/n junction. However, Yamashita et al. disclose a p/n junction. Please see the rejection of claim 29.
- Applicant argues Ishibashi et al. would not have provided any motivation toward the particular thickness range of an Au film that is suitable for preventing the formation of a p/n junction between such opposite type semiconductor material. However, the present prosecution is for a semiconductor device. Ishibashi et al., modified Woodard et al., would provide an Au thin film of 0.6 to 30 Å in thickness. The usage of the Au thin film does not carry any patentable weight.
- Applicant argues that Ishibashi et al. is completely unknown to provide an Au film with a thickness of 1-3 nm in any context whatsoever and Woodard et al. teach the Au film is a heat reflective or electrical conductive layer. These

teachings say nothing about whether such a thin layer would have been effective as the Au film 14 in the light-emitting device. However, Ishibashi et al. disclose a light-emitting device with an Au thin film and Woodard et al. provide a teaching of an effective range of an Au film could serve as a transparent electrode.

Therefore, the combination of Ishibashi et al. and Woodard et al. meet the limitation of claim 16. How effective of the Au film is a process limitation, which does not carry any patentable weight.

- Applicant argues that Ishibashi et al. has no motivation to combine with Kazuyoshi et al. to provide a flattened Au film and an uneven upper electrode. However, Ishibashi et al. disclose a multi-layers upper electrode having an Au film as one of the layer. Kazuyoshi et al. teach a metal base in contact with the semiconductor material to form good ohmic contact. Therefore, the combination of Ishibashi et al. and Kazuyoshi et al. is proper.

### *Conclusion*

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period

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will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

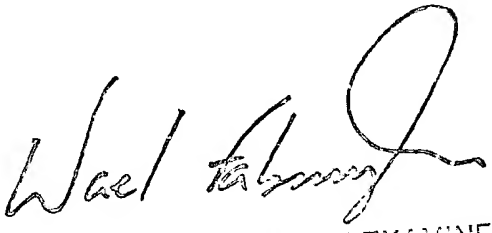
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wai-Sing Louie whose telephone number is (703) 305-0474. The examiner can normally be reached on 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

wsf

January 24, 2003

  
SUPERVISORY PRIMARY EXAMINER  
TECHNOLOGY CENTER 2800